## REMARKS

Reconsideration of the above referenced application in view of the following remarks is requested. In the specification, the paragraph from page 14, line 23 to page 15, line 7 has been amended to correct an editorial error. In the Claims, claims 22-24 have been cancelled. Existing claims 1-21 and 25-39 remain in the application.

## ARGUMENT

***Claim Rejections – 35 U.S.C. § 101***

Claims 1-36 are rejected under 35 U.S.C. § 101 because invention is directed to non-statutory matter.

Claims 22-24 have been cancelled. The 35 U.S.C. § 101 rejections over these claims are now moot and should be withdrawn.

Regarding independent claims 1, 12, 16, 19, 25, and 36, they are rejected under the basically same rationale, i.e., the claimed invention does not produce a "useful, concrete and tangible result." Specifically, the Examiner rejected these independent requirements for failing to meet the tangible requirement by citing Section IV.C.2b.(2) of the Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility (hereinafter "Interim Guidelines").

Applicant respectfully disagrees. First, the Examiner stated that the subject matter claimed in independent claims 1, 12, 16, 19, 25, and 36 is software, which is non-statutory subject matter per se. Applicant is not aware of such a per se rule against software. Applicant has checked with the MPEP 2106 and the Interim Guidelines, but could not find such a per se rule. Applicant appreciates if the Examiner particularly

points out the source of this per se rule in the next Office Action. Unless this per se rule is supported by authorities, Applicant must assume that there is no such a per se rule against software patentability.

Second, when rejecting independent claims 1, 12, 16, 19, 25, and 36, the Examiner stated, "Claims [1, 12, 16, 19, 25, 36] have the result of producing 'real-world' results related to 'performing mark-sweep garbage collection' however the claim[s] do not specify that the result neither output nor displayed to a user or otherwise used in the real world, but does not output useful, concrete and tangible result." Applicant has hard time understanding what the Examiner really means here. If these claims have the result of producing "real-world" results, then they are statutory. I guess that the Examiner here really means that because these claims does not output or display to a user and the subject matter claimed in them is not used in the real world, they do not produce a useful, concrete and tangible result. If this is really what the Examiner means here, Applicant respectfully disagrees for two reasons: 1) nowhere can Applicant find in the MPEP § 2106 or in the Interim Guidelines such a requirement that a claim must output or display to a user; and 2) the subject matter claimed in these claims is used in the real world. As for the first reason, Applicant appreciates if the Examiner can point out the source of such a requirement in the next Office Action. Unless such a requirement is supported by an authority, Applicant must assume that there is no such a requirement. As for the second reason, the subject matter ("mark-sweep garbage collection") claimed in independent claims is used in the real world as evidenced by references (e.g., Kuiper patent and Czajkowski patent cited by the Examiner for the 35 U.S.C. § 102 rejections over the same claims.

Finally, Applicant strongly believes that what is claimed in independent claims 1, 12, 16, 19, 25, and 36 does produce a useful, concrete and tangible result. The Examiner appears to agree that what is claimed in these claims produce a useful and concrete result, but does not agree that it produces a tangible result. According the Interim Guidelines (Section IV.C.2b.(2)), "the opposite meaning of 'tangible' is 'abstract'." Independent claims 1, 12, 16, 19, 25, and 36 do not claim abstract ideas. Each of them claims a certain aspect of what is happening in any computer which conducts mark-sweep garbage collection. Each claim makes it very clear that those actions recited therein are performed with computer memory heaps/storage space, which are/is tangible. Particularly, each claim also recites a different aspect of bit vectors, which are not abstract. The result produced by each claim is that garbage is collected and there is more storage space in heaps for a running application. Such a result is tangible but not abstract.

For the foregoing reasons, the subject matter claimed in independent claims 1, 12, 16, 19, 25, and 36 is statutory and thus patentable under 35 U.S.C. § 101. Accordingly, all of the claims that depend therefrom (i.e., claims 2-11; 13-15; 20-21; 26-35, and 37-39; respectively) are also patentable under 35 U.S.C. § 101. Applicant hereby respectfully requests that the 35 U.S.C. § 101 rejections over claims 1-21 and 25-39 be withdrawn.

***Double Patenting***

Claim 1, 12, 16, 19, 22, 25, and 36 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over

claims 1, 17, 24, 29, 32 of co-pending Application No. 10/793,707, filed on 3/3/2004, although conflicting claims are not identical, they are not patentably distinct from each other.

Claim 22 has been cancelled. The double patenting claim rejection over this claim is now moot and should be withdrawn.

A terminal disclaimer in compliance with 37 CFR § 1.321(c) is filed along with this response to overcome the provisional rejections of claims 1, 12, 16, 19, 25, and 36 based on the nonstatutory double patenting ground because the conflicting application has been commonly owned with the present application.

***Claim Rejections – 35 USC § 102***

Claims 1-11 and 22-35 are rejected under 35 U.S.C. § 102(b) as being anticipated by Kuiper, US Patent No. 6,324,631, published on Nov 27, 2001 (hereinafter Kuiper).

Claims 22-24 have been cancelled. The 35 U.S.C. § 102 rejections over these claims are not moot and should be withdrawn.

A claim is anticipated under §102 "only if each and every element set forth in the claim is described, either expressly or inherently, in a single prior art reference." See M.P.E.P § 2131 (Quoting Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987)). Applicant submits that the Examiner has failed to establish a prima facie case of anticipation for independent claims 1 and 25 because Kuiper does not disclose at least the limitation of two bit vectors in a heap block (i.e., a first bit vector and a second bit vector) recited in claims 1 and 25.

In rejecting claims 1 and 25, the Examiner cited col. 2, lines 9-10, Figs 5A-5B, col. 5, lines 39-48 and lines 51-52, col. 6, lines 52-64, and col. 7, lines 21-30 as disclosing the limitation—performing mark-sweep garbage collection, concurrently while executing the application, in a heap block of the heap using a first bit vector, a second bit vector, a mark bit vector pointer, and a sweep bit vector pointer in the heap block, if the available space falls below the threshold, as recited in claims 1 and 25. Applicant respectfully disagrees. None of the cited portions discloses two bit vectors (a first bit vector and a second bit vector). Col. 2, lines 9-10 and Figs 5A-5B simply mentions mark/sweep garbage collection. Col. 5, lines 39-48 discloses a mark bit array (202 in Fig. 2), but there is only one array (vector) and there is no second bit vector. Col. 5, lines 51-52 states, "During the mark phase, one bit is set corresponding to the beginning of each live object with the memory heap." Again it talks about only one bit vector and there is no second bit vector. Col. 6, lines 52-64 discloses how sweep is performed using the mark bit in the bit array, but it does not disclose a second bit vector. Col. 7, lines 21-30 discloses how to balance the speed of memory sweep but does not disclose a second bit vector.

Because Kuiper does not disclose the above mentioned limitation, particularly, a second bit vector which is used for improving the concurrency between the mark and sweep phases, claims 1 and 25 are not anticipated by Kuiper. Accordingly, all of the claims that depend therefrom (i.e., claims 2-11 and claims 26-35, respectively) are not anticipated by Kuiper either. Therefore, claims 1-11 and 25-35 are patentable over Kuiper. Applicant respectfully requests that the 35 U.S.C. § 102 rejections over these claims be withdrawn.

Claims 12-15, 19-21, and 36-39 are rejected under 35 U.S.C. § 102(a) as being anticipated by Czajkowski, US Patent No. 6,594,749, published on July 15, 2003 (hereinafter Czajkowski).

Regarding independent claims 12 and 36, the Examiner failed to establish a prima facie case of anticipation because (1) Czajkowski does not disclose "receiving a first code, compiling the first code into a second code, executing the second code in at least on thread;" and (2) Czajkowski does not disclose "automatically performing mark-sweep garbage collection using bit vector toggling, concurrently with the executing second code, to ensure there is storage space available for executing the second code."

The Examiner cited col. 2, lines 41-49, col. 3, lines 39-41, and col. 3, lines 57-60 as disclosing "receiving a first code, compiling the first code into a second code, executing the second code in at least on thread." Applicant respectfully disagrees. Col. 2, lines 41-49 is quoted below:

> A garbage collector must determine which data structures, such as objects, are in use and which are not. A program executing a set of methods may have arguments or local variables that are references to objects. These references are said to belong to a root set of references that are immediately accessible to the program. All objects referenced by this root set of references are said to be readable by the program in its current state and should not be collected by a garbage collector.

Basically, this cited portion explains what a root set is. It has nothing to do with the claimed limitation. Col. 3, lines 39-41 provides, "In one embodiment, the data structure may be an object in an object-oriented language such as C++ or the Java™ language," which has nothing to do with the claimed limitation. Col. 3, lines 57-60 provides,

"Finally, the allocated memory blocks may be linked in a list such that the components of the structure are partitioned in the particular order of the components across the allocated memory blocks." Again, Applicant cannot find anything related to the claimed limitation in this portion of Czajkowski cited by the Examiner.

The Examiner cited col. 1, lines 32-36, col. 2, lines 16-20, col. 7, lines 34-37, col. 2, lines 61-65, and col. 7, lines 24-34 as disclosing the limitation of "automatically performing mark-sweep garbage collection using bit vector toggling, concurrently with the executing second code, to ensure there is storage space available for executing the second code." Again Applicant respectfully disagrees. Col. 1, lines 32-36 discloses the problem associated with reclaimed memory compaction. Note that the present application does not disclose mark/sweep/compact garbage collection, i.e., memory compaction is not performed by the garbage collection disclosed in the present application. Col. 2, lines 16-20 discloses mark bit, but says nothing about bit vector toggling which needs two bit vectors. Col. 7, lines 34-37 discloses that the status bit of the memory block in the heap may be stored as a bit in a bitmap, but it does not disclose anything related to bit vector toggling. Col. 2, lines 61-65 explains what garbage collection is and how the process is performed, but it has nothing to do with bit vector toggling. Col. 7, lines 24-34 discloses how the memory is allocated and how a memory block is marked, but again it does not disclose bit vector toggling.

Because Czajkowski does not disclose all of the limitations recited in independent claims 12 and 36, these two claims are not anticipated by Czajkowski. Accordingly, all of the claims that depend therefrom are not anticipated by Czajkowski either. Thus, claims 12-15 and 36-39 are patentable over Czajkowski. Applicant

respectfully requests that the 35 U.S.C. § 102 rejections over these claims be withdrawn.

Regarding independent claim 19, the Examiner also failed to establish a prima facie case of anticipation because Czajkowski does not disclose at least the limitation of "a garbage collector to trace live objects, mark the live objects in a first bit vector pointed to by a mark bit vector pointer in a heap block of a heap, and toggle the bit first vector pointed to by the mark bit vector pointer with a second bit vector pointed to by a sweep bit vector pointer at the end of marking phase, concurrently with execution of the application." Particularly, Czajkowski does not disclose anything related to the toggling aspect of this limitation.

The Examiner cited col. 7, line 2-21, col. 7, line 24-37, line 64-67, and col. 8, lines 1-18 as disclosing the above limitation. Applicant respectfully disagrees. Col. 7, lines 2-37 discloses some aspect of the mark phase and how to set the mark bits, but it says nothing about the toggling aspect, which needs two bit vectors—one for marking and one for sweeping. Col. 7, line 64 to col. 8, line 18 discloses how the current pointer (340) moves and how memory blocks are marked, but there is no toggling between two bit vectors because there is no second bit vector at all.

Because Czajkowski does not disclose all of the limitations recited in independent claim 19, this claim is not anticipated by Czajkowski. Accordingly, all of the claims that depend therefrom (i.e., claims 20-21) are not anticipated by Czajkowski either. Thus, claims 19-21 are patentable over Czajkowski. Applicant respectfully requests that the 35 U.S.C. § 102 rejections over these claims be withdrawn.

Claims 16-18 are rejected under 35 U.S.C. § 102(e) as being anticipated by Andreasson, US Pub. No. 2004/0073764 filed on July 30, 2003 (hereinafter Andreasson).

The Examiner cited paragraph [0123], [0151-0152], and [0156] as disclosing: "a live object tracing mechanism to parallel trace live objects in a heap block and mark the live objects in a first bit vector pointed to by a mark bit vector pointer in the heap block, concurrently with execution of an application; and a garbage sweeping mechanism to sweep storage space occupied by garbage objects to make the storage space allocable using a second bit vector pointed to by a sweep bit vector pointer in the heap block, concurrently with the execution of the application and live object marking." Applicant respectfully disagrees because none of these paragraphs disclose a second bit vector is used for sweeping. The cited paragraphs only disclose some aspects of marking.

Because Andreasson does not disclose all of the limitations recited in independent claim 16, this claim is not anticipated by Andreasson. Accordingly, all of the claims that depend therefrom (i.e., claims 17-18) are not anticipated by Andreasson either. Thus, claims 16-18 are patentable over Andreasson. Applicant respectfully requests that the 35 U.S.C. § 102 rejections over these claims be withdrawn.

## CONCLUSION

Based on the foregoing, it is submitted that that all active claims (i.e., claims 1-21 and 24-39) are presently in condition for allowance, and their passage to issuance is respectfully solicited. If the Examiner has any questions, the Examiner is invited to contact the undersigned at (503) 264-1700. Entry of this amendment is respectfully requested.

Respectfully submitted,

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